U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.10 SEISMIC AND DYNAMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

REVIEW RESPONSIBILITIES

Primary - ~~Equipment Qualification Branch (EQB)~~Mechanical Engineering Branch (EMEB)[1]

Secondary - ~~none~~Instrumentation and Controls Branch (HICB)[2]

I. AREAS OF REVIEW

Information concerning the methods of test and analysis employed to ~~assure~~ensure[3] the operability of mechanical and electrical equipment (includes instrumentation and control) under the full range of normal and accident loadings (including seismic) should be provided in the applicant's safety analysis report (SAR) and is reviewed by the ~~EQB~~EMEB[4] to ~~assure~~ensure[5] conformance with the requirements of General Design Criteria 1, 2, 4, 14, and 30 of Appendix A to 10 CFR Part 50, as well as Appendix B to 10 CFR Part 50 and Appendix A to 10 CFR Part 100. Mechanical and electrical equipment must be designed to withstand the effects of earthquakes, i.e., seismic Category I requirements, and other accident-related loadings.

Mechanical and electrical equipment covered by this Standard Review Plan (SRP)[6] section includes equipment associated with systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment. Also covered by this SRP section is equipment (1) that performs the above functions automatically, (2) that is used by the operators to perform these functions manually, and (3) whose failure can prevent the satisfactory accomplishment of one or more of the above safety functions. Instrumentation that is needed to assess plant and environs conditions during and after an accident, as described in Regulatory Guide 1.97, is also covered by this

SRP section.[7] Examples of mechanical equipment included in these systems are pumps, valves, fans, valve operators, snubbers,[8] battery and instrument racks, control consoles, cabinets, and panels. Examples of electrical equipment are valve operator motors, solenoid valves, pressure switches, level transmitters, electrical penetrations, and pump and fan motors.

The EMEB has the responsibility, in accordance with SRP Section 3.9.2, for defining the seismic and dynamic input motion for all pipe mounted equipment. In addition, the EMEB has the primary responsibility, in accordance with SRP Section 3.2.2, for defining the systems that perform the functions delineated in the previous paragraph.[9]

The HICB, in fulfilling its secondary review responsibility, verifies that all instrumentation and controls for the equipment described in the previous paragraphs, as well as for Category 1 accident monitoring instrumentation as defined in Regulatory Guide 1.97, are included in the seismic and dynamic qualification program and that the performance aspects of these items are included in the seismic and dynamic qualification testing.[10]

At the construction permit (CP) or design certification[11] stage, the staff review covers the following specific areas:

1. The criteria for qualification, such as the deciding factors for choosing between tests or analyses, the considerations in defining the seismic and other relevant dynamic load input motions, and the demonstration of adequacy of the qualification program.

2. The methods and procedures including tests and analyses, used to ~~assure~~ ensure[12] structural integrity and the operability of mechanical and electrical equipment in the event of a safe shutdown earthquake (SSE), after a number of postulated occurrences of the operating basis earthquake (OBE), and in combination with other relevant dynamic and static loads.

3. The methods and procedures of analysis or testing of the supports for mechanical and electrical equipment, and the procedures used to account for possible amplification of vibratory motion (amplitude and frequency content) under seismic and dynamic conditions.

At the operating license (OL) stage, the staff audits the equipment qualification files and reviews the results of tests and analyses to ~~assure~~ ensure[13] the proper implementation of criteria established in the CP review, to ~~assure~~ensure[14] that adequate qualification has been demonstrated for all equipment and their supports, and to verify that all applicable loads have been properly defined and accounted for in the testing/analyses performed.

Review Interfaces[15]

The EMEB will also review the locations and dynamic effects of postulated pipe ruptures as part of its primary review responsibility for SRP Section 3.6.2.[16]

~~EQB~~EMEB[17] will coordinate other branches' evaluations that interface with the overall review as follows~~:~~:[18]

1.[19] SEBThe Civil Engineering and Geosciences Branch (ECGB)[20] has the responsibility in accordance with SRP Section 3.7 for defining the seismic and dynamic input motion for all floor and wall mounted equipment. ~~MEB has the responsibility in accordance with SRP Section 3.9.2 for defining the seismic and dynamic input motion for all pipe mounted equipment. In addition, MEB has the primary responsibility, in accordance with SRP Section 3.2.2, for defining the systems that perform the functions delineated in paragraph 2 of Subsection I of this SRP section.~~[21]

2. The Materials and Chemical Engineering Branch (EMCB) reviews the adequacy of programs for assuring the integrity of bolting and threaded fasteners, including provisions for installation and maintenance of mounting and bolting details equivalent to those used for equipment qualification, as part of its primary review responsibility for SRP Section 3.13.[22]

For those areas of review identified as part of the primary responsibility of other branches, the acceptance criteria and methods of application are contained in the referenced SRP section.

II. ACCEPTANCE CRITERIA

The acceptance criteria for the areas of review designated in subsection I are based on meeting the relevant requirements of the following regulations:

A. General Design Criteria 1 (GDC 1)[23] and 30 (GDC 30)[24] as they relate to qualifying equipment to appropriate quality standards commensurate with the importance of the safety functions to be performed.

B. General Design Criterion 2 (GDC 2)[25] and Appendix A to 10 CFR Part 100 as they relate to qualifying equipment to withstand the effects of natural phenomena such as earthquakes.

C. General Design Criterion 4 (GDC 4)[26] as it relates to qualifying equipment being capable of withstanding the dynamic effects associated with external missiles and internally generated missiles, pipe whip, and jet impingement forces.

D. General Design Criterion 14 (GDC 14)[27] as it relates to qualifying equipment associated with the reactor coolant boundary so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure and of gross rupture.

E. Appendix B to 10 CFR Part 50 as it relates to qualifying equipment using the quality assurance criteria provided.

Specific criteria, regulatory guides, and industry standards that provide information, recommendations and guidance, and in general describe a basis acceptable to the staff that may be used to implement the requirements of the regulations identified above are as follows:~~:~~[28]

Acceptable load combinations and methods for combining dynamic responses for mechanical equipment are defined in SRP Section 3.9.3. The same criteria is acceptable for electrical equipment.

Acceptable testing and analysis procedures for confirming the operability of equipment for the defined load condition are presented in paragraphs 1 and 2 below. These criteria, when satisfied, will fulfill the requirements of GDC 2 and GDC 4, as discussed above, and paragraphs XI of Appendix B to 10 CFR 50 and VI(a)(1) and (2) of Appendix A to 10 CFR Part 100 as they relate to the qualification of equipment.

1. ~~For plants for which the CP application was docketed after October 27, 1972, the~~The[29] qualification of electrical equipment and their supports should meet the requirements and recommendations of ~~IEEE Std. 344-1975~~ANSI/IEEE Std 344-1987[30] ~~and the Regulatory Position of Regulatory Guide 1.100, which endorses IEEE Std. 344-1975.~~ as endorsed by Regulatory Guide 1.100.[31] These documents are generally applicable to all types of equipment and should be used to the extent practicable for the qualification of mechanical equipment as well. Specifically, conformance to the following criteria should be demonstrated.

   a. Qualification for Equipment Operability

      (1) Tests and analyses are required to confirm the operability of all mechanical and electrical equipment during and after an earthquake of magnitude up to and including the OBE and SSE, and for all static and dynamic loads from normal, ~~transient~~anticipated operational occurrence[32] and accident conditions. Prior to SSE qualification, it should be demonstrated that the equipment can withstand the OBE excitation without loss of structural integrity. Analyses alone, without testing, are acceptable as a basis for qualification only if the necessary functional operability of the equipment is ~~assured~~ensured[33] by its structural integrity alone. When complete testing is impractical, a combination of tests and analyses is acceptable.

      Equipment that has been previously qualified by means of tests and analyses equivalent to those described here are acceptable provided that proper documentation of such tests and analyses is submitted.

      (2) Equipment should be tested in the operational condition. Operability should be verified during and/or after the testing, as applicable to the equipment being tested. Loadings simulating those of plant normal

operation, such as thermal and flow-induced loading, if any, should be concurrently superimposed upon the seismic and other pertinent dynamic loading to the extent practicable. Particular attention should be paid, in operability qualification of mechanical equipment subjected to flow-induced loading, to incorporate degraded flow conditions such as those that might be encountered by the presence of debris, impurities, and contaminants in the fluid system. An example of this may be the operability of the containment sump pump recirculating water full of debris.

(3) The characteristics of the required seismic and dynamic input motions should be specified by response spectrum or time history methods. These characteristics, derived from the structures or systems seismic and dynamic analyses, should be representative of the input motions at the equipment mounting locations, except as noted in subsection II.2.[34]

(4) For seismic and dynamic loads, the actual test input motion should be characterized in the same manner as the required input motion, and the conservatism in amplitude and frequency content should be demonstrated (i.e., the test response spectrum (TRS) should closely resemble and envelope the required response spectrum (RRS) over the critical frequency range).

(5) Since seismic and the dynamic load excitation generally have a broad frequency content, multifrequency vibration input motion should be used. However, single frequency input motion, such as sine beats, is acceptable provided the characteristics of the required input motion indicate that the motion is dominated by one frequency (e.g., by structural filtering effects), or the anticipated response of the equipment is adequately represented by one mode, or in the case of structural integrity assurance, the input has sufficient intensity and duration to produce sufficiently high levels of stress for such assurance. Components that have been previously tested to IEEE Std 344-1971 should be reevaluated to justify the appropriateness of the input motion used, and requalified if necessary.

(6) For the seismic and dynamic portion of the loads the test input motion should be applied to one vertical axis and one principal horizontal axis (or two orthogonal horizontal axes) simultaneously unless it can be demonstrated that the equipment response in the vertical direction is not sensitive to the vibratory motion in the horizontal direction, and vice versa. The time phasing of the inputs in the vertical and horizontal directions must be such that a purely rectilinear resultant input is avoided. An acceptable alternative is to test with vertical and horizontal inputs in-phase, and then repeat the test with inputs 180 degrees out-of-phase. In addition, the test must be repeated with the equipment rotated 90 degrees horizontally.

Components that have been previously tested to IEEE Std 344-1971 should be requalified using biaxial test input motions unless justification for using a single axis test input motion is provided.

(7) Dynamic coupling between the equipment and related systems, if any, such as connected piping and other mechanical components, should be considered.

(8) The fixture design should simulate the actual service mounting and should not cause any extraneous dynamic coupling to the test item.

(9) For pumps and valves, the loads imposed by the attached piping should be properly taken into account. In order to ~~assure~~ensure[35] operability under combined loadings, the stresses resulting from the applied test loads should envelope the specified service stress limit for which the component's operability is intended. Stresses in valve bodies and pump casings should be limited to the particular material's elastic limit when the pump or valve is subject to the combination of normal operating loads, SSE, and other applicable dynamic loads.[36]

(10) If the dynamic testing of a pump or valve assembly proves to be impracticable, static testing of the assembly is acceptable provided that the end loadings are conservatively applied and are equal to or greater than postulated event loads, all dynamic amplification effects are accounted for, the component is in the operating mode during and after the application of loads, and an adequate analysis is made to show the validity of the static application of loads.

(11) The in situ application of vibratory devices to simulate the seismic and dynamic vibratory motions on a complex active device is acceptable to confirm the operability of the device when it is shown that a meaningful test can be made in this way.

(12) The test program may be based upon selectively testing a representative number of components according to type, load level, size, etc., on a prototype basis.

(13) Selection of damping values for equipment to be qualified should be made in accordance with Regulatory Guide 1.61 and ~~IEEE Std. 344-1975~~ANSI/IEEE Std 344-1987.[37] Higher damping values may be used if justified by documented test data with proper identification of the source and mechanism.

(14) When complete testing is not practicable, the features listed below should be incorporated into a test and analysis operability assurance program for pumps and valves. Similar programs can be developed for other types of equipment.

(a) Simple and passive elements, such as valve and pump bodies and their related piping and supports may be analyzed to confirm structural integrity under postulated event loadings. However, complex active devices such as pump motors, valve operator and gate or disk assemblies, and other electrical, mechanical, pneumatic, or hydraulic appurtenances which are vital to the pump or valve operation should be tested for operability.

(b) The following analyses are acceptable provided they are correlated to classical problems, elementary laboratory tests, or in situ tests:

i. An analysis is performed to determine the vibratory input to the valve or pump.

ii. An analysis is performed to determine the system natural frequencies and the movement of the pump or valve during the dynamic events.

iii. An analysis is performed to determine the pressure differential and the impact energy on a valve disc during a loss-of-coolant accident (LOCA),[38] and to verify the design adequacy of the disc.

iv. An analysis is performed to determine the forcing functions of the axial and radial loads imposed on a pump rotor due to a LOCA, such that combined LOCA and vibratory effects on the shaft and rotor assembly can be evaluated.

v. An analysis is performed to determine the speed of the pump shaft as a result of postulated events and to compare it with the design critical speed.

vi. An analysis is performed to verify the design adequacy of the wall thickness of valve and pump pressure retaining bodies.

vii. An analysis is performed to determine the natural frequencies of a pump shaft and rotor assembly to ascertain whether they are within the frequency range of the vibratory excitations. If the minimum natural frequency of the assembly is beyond the excitation frequencies, a static deflection analysis of the shaft is acceptable to account for dynamic effects. If the assembly natural frequencies are close to the excitation frequencies, an acceptable dynamic analysis must be performed to determine the structural response of the assembly to the excitation frequencies.

viii. When analyses are used for qualification, the combination of multimodal and multidirectional responses should be made in accordance with Regulatory Guide 1.92.

b. Design Adequacy of Supports

(1) Analyses or tests should be performed for all supports of mechanical and electrical equipment to ~~assure~~ensure[39] their structural capability.

(2) The analytical results should include the required input motions to the mounted equipment as obtained and characterized in the manner stated in subsection II.1.a(3) above, and the combined stresses of the support structures should be in accordance with the criteria specified in SRP Section 3.9.3.

(3) Supports should be tested with equipment installed or with a dummy simulating the equivalent equipment inertial mass effects and dynamic coupling to the support. If the equipment is installed in a nonoperational mode for the support test, the response in the test at the equipment mounting location should be monitored and characterized in the manner as stated in subsection II.1.a(3) above. In such a case, equipment should be tested separately for operability and the actual input motion to the equipment in this test should be more conservative in amplitude and frequency content that the monitored response from the support test.

(4) The criteria of subsections II.1.a(3), (4), (5), (6), (7), (8), and (13) above, are applicable when tests are conducted on the equipment supports.

c. Verification That Seismic and Dynamic Qualification Is Performed in the Proper Sequences of the Overall Qualification Program

~~As defined in Part B of Regulatory Guide 1.100, IEEE Std. 344-1975 is an ancillary standard of IEEE Std 323-1974 (endorsed with exceptions by Regulatory Guide 1.89. In accordance with this standard, for plants whose construction permit SER is dated July 1, 1974, or later, the seismic and dynamic testing portion of the overall qualification should be performed in its proper sequence as indicated in Section 6 of IEEE Std. 323-1974.~~The seismic and dynamic qualification testing performed in accordance with Regulatory Guide 1.100 and ANSI/IEEE Std 344-1987 as part of an overall qualification program should be performed in the sequence indicated in Section 6 of IEEE Std 323-1974 (endorsed with exceptions by Regulatory Guide 1.89).[40]

2. Instrumentation described in Regulatory Guide 1.97, including associated mountings, should be tested under appropriate seismic and dynamic loadings as described therein, thereby ensuring that the instruments will continue to monitor plant variables and systems after a seismic event and/or accident.[41]

2. For plants for which the CP application was docketed before October 27, 1972, applicants should describe the extent to which the seismic and dynamic qualification of mechanical and electrical equipment and their supports meet the criteria of Subsection II.1 above. For equipment that does not meet these requirements, justification should be provided for the use of other criteria. As a minimum, the electrical equipment and their supports should meet the requirements of IEEE Std. 344-1971. It should be demonstrated that all equipment has adequate margin to perform their intended design functions during seismic and dynamic events when considering the effects of possible multi-mode response and simultaneous vertical and horizontal excitations on equipment operability. Specifically, in addition to the criteria of Subsection II.1.a.(1), (2), (7), (8), (9), (10), (11), (12), (13), and (14) above, the following criteria are applicable.

a. Qualification for Equipment Operability

(1) Single frequency input excitations, such as continuous single frequency sinusoidal motions or sine beat motions may be used; however, multifrequency input excitations as delineated in IEEE Std. 344-1975 are preferable and should be utilized whenever possible. In either case, the maximum input motion acceleration should equal or exceed the maximum seismic and dynamic acceleration expected at the equipment mounting location. See Subsection II.2.b.(3) below for a discussion of the participation of the equipment supports.

(2) For single frequency input excitation, the discrete frequencies at which the test input motion is applied should cover 1-33 Hz for seismic loads. For other dynamic loads, such as in the case of hydrodynamic loads for Mark II and III containments, larger frequency ranges may be required. If resonant frequencies of the equipment and equipment supports are identified by prior analysis or "sweep" testing or both, tests conducted only at the resonant frequencies are acceptable. However, if multifrequency input excitations are used, the level of response spectrum derived from the test input should envelope the corresponding response spectrum level required for seismic and dynamic qualification at the component mounting location.

(3) The test motion may be applied to one vertical and two orthogonal horizontal axes separately. However, biaxial input with simultaneous vertical and horizontal excitations as delineated in IEEE Std. 344-1975 is preferable and should be utilized whenever possible.

b. Design Adequacy of Supports

(1) Analyses or tests should be performed for all supports of mechanical and electrical equipment to assure their structural capability.

(2) The analytical results should include the maximum accelerations and associated frequencies at the equipment mounting location, and the

~~combined stresses of the support structures should be in accordance with the criteria specified in SRP Section 3.9.3.~~

~~(3) Supports should be tested with equipment installed or with a dummy simulating the equivalent inertial mass effects and dynamic coupling to the support. If the equipment is installed in a nonoperational mode for the support test, the response at the equipment mounting location should be monitored such that the maximum accelerations and associated frequencies can be defined. In such a case, equipment should be tested separately for operability and the actual input motion to the equipment should be more conservative in amplitude and frequency content than the monitored response.~~

~~(4) The criteria of Subsections II.1.a.(7), (8), and (13) and II.2.a.(1), (2), and (3), above, are applicable when tests are conducted on the equipment supports.~~[42]

3. GDC 1 of Appendix A and paragraph XVII of Appendix B to 10 CFR 50 establish requirements for records concerning the qualification of equipment. In order to satisfy these requirements, complete and auditable records must be available and maintained by the applicant, for the life of the plant, at a central location. Their files should describe the qualification method used for all equipment in sufficient detail to document the degree of compliance with the criteria of this SRP section. These records should be updated and maintained current as equipment is replaced, further tested, or otherwise further qualified.

   The equipment qualification file should contain a list of all systems, equipment and the equipment support structures, as defined in ~~paragraph 2~~the second paragraph[43] of subsection I. The equipment list should identify which equipment is nuclear steam supply system (NSSS)[44] supplied and which equipment is balance of plant (BOP),[45] supplied. The equipment qualification file should also include qualification summary data sheets for each piece of equipment, i.e., each mechanical and electrical component of each system, which summarize the component's qualification. These data sheets should include the following information:

   a. Identification of equipment, including vendor, model number and location within each building. Valves that are part of the reactor coolant pressure boundary (RCPB)[46] should be so identified.

   b. Physical description, including dimensions, weight and field mounting condition. Identification of whether the equipment is pipe, floor, or wall supported.

   c. A description of the equipment's function within the system.

   d. Identification of all design (functional) specifications and qualification reports, and their locations. Functional specifications for active valve assemblies should confirm to the Regulatory Position of Regulatory Guide 1.148.

e. Description of the required loads and their intensities for which the equipment must be qualified.

f. If qualification by test, identification of the test methods and procedures, important test parameters and a summary of the test results.

g. If qualification by analysis, identification of the analysis methods and assumptions and comparisons between the calculated and allowable stresses and deflections for critical elements.

h. The natural frequency (or frequencies) of the equipment.

i. Identification of whether the equipment may be affected by vibration fatigue cycle effects and a description of the methods and criteria used to qualify the equipment for such loading conditions.

j. Indicate whether the equipment has met the qualification requirements.

k. Availability for inspection, i.e., identify whether the equipment is already installed.

l. A compilation of the required response spectra (or time history) and corresponding damping for each seismic and dynamic load specified for the equipment together with all other loads considered in the qualification and the method of combining all loads.

4. ~~General Design Criterion 14~~GDC 14[47] of Appendix A to 10 CFR 50 requires, in part, that the ~~reactor coolant pressure boundary~~ RCPB[48] shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage. ~~General Design Criterion 30~~ GDC 30[49] further requires, in part, that components which are part of the ~~reactor coolant pressure boundary~~ RCPB shall be designed, fabricated, erected, and tested to the highest quality standards practical.

In order to satisfy these requirements, the qualification program for valves that are part of the ~~reactor coolant pressure boundary~~ RCPB should include testing or testing and analyses that demonstrate these valves will not experience any leakage, or increase in leakage, as a result of any loading or combination of loadings that the valves must be qualified for.

5. In documenting the implementation of the qualification program described above, the following information should be included in the indicated documents.

a. The preliminary safety analyses report (PSAR)[50] should contain:

(1) A detailed description of NSSS and architect/engineer (A/E)[51] practice followed in qualification, including criteria, methods, and procedures used in conducting testing and analysis, which demonstrate the extent of

compliance with the criteria set forth in subsections II.1, 2, 3, and 4 above.

(2) Information regarding administrative control of component qualification, especially a description of the equipment qualification file, the handling of documentation, internal acceptance review procedures, identification of the scope of NSSS and A/E suppliers, and the procedures of the interchange of information between NSSS, A/E, equipment vendors and testing laboratories.

b. In addition to the information contained in the PSAR, as revised, the final safety analyses report (FSAR)[52] should contain:

(1) A list of all systems required to perform the functions defined in ~~paragraph 2~~the second paragraph[53] of subsection I.

(2) A description of the results of any in-plant tests, such as in situ impedance tests, and any plans for operational tests which will be used to confirm the qualification of any item of equipment.

c. The seismic qualification report (SQR) should contain:

(1) The list of systems required to perform the functions defined in ~~paragraph 2~~the second paragraph[54] of subsection I.

(2) The list of equipment, and their supports, associated with each system, and any other equipment required in accordance with ~~paragraph 2~~the second paragraph[55] of subsection I.

(3) The summary data sheets for each piece of equipment, i.e., each component, listed.

d. Combined license (COL) applications should include the information described in subsections II.5.a, b, and c, as well as the following:

(1) A description of the environmental parameters applicable to the specific plant and its equipment qualification program.

(2) Documentation to demonstrate that properly defined and enveloped seismic and dynamic input response spectra have been applied to the specific plant and its equipment qualification program.[56]

Technical Rationale

The technical rationale for application of these acceptance criteria to reviewing seismic and dynamic qualification of mechanical and electrical equipment is discussed in the following paragraphs:[57]

1. Compliance with GDC 1 requires that (a) testing be done in accordance with quality standards commensurate with the importance of the safety functions to be performed, (b) test standards be applicable and sufficient, and (c) appropriate records be maintained.

   GDC 1 applies to this SRP section because the reviewer evaluates seismic and dynamic test and evaluation programs for electrical and mechanical equipment, plus associated supports, designated as important to safety. ANSI/IEEE Std 344-1987, as endorsed by Regulatory Guide 1.100, provides guidance for establishing acceptable seismic and dynamic test (and/or evaluation) qualification and documentation criteria for electric and mechanical equipment in nuclear power plants. Supplemental guidance is offered in SRP Section 3.10 regarding acceptable techniques for combining seismic loads with other loads and conditions, modeling of supports, documentation, and evaluation of results.

   Meeting the requirements of GDC 1 provides assurance that the seismic and dynamic qualification of electrical and mechanical equipment important to safety will comply with established criteria, thereby ensuring its capability to perform required safety functions during and after exposure to design basis seismic and dynamic loads.[58]

2. Compliance with GDC 2 requires that systems, structures, and components important to safety be designed to withstand the effects of expected natural phenomena, combined with appropriate effects of normal and accident conditions, without loss of capability to perform their safety functions.

   GDC 2 applies to this SRP section because the reviewer evaluates testing and analysis of electrical and mechanical equipment, plus associated supports, for the capability to resist seismic and dynamic loads. Pertinent staff positions include extensive and specific provisions for tests and analyses to consider all appropriate seismic and dynamic loads in combination with normal and accident loads. SRP Section 3.10 cites guidance for testing and analysis that is acceptable to the staff for ensuring that mechanical and electrical equipment will withstand all appropriate combinations of seismic and dynamic effects caused by natural phenomena.

   Meeting the requirements of GDC 2 provides assurance that the seismic and dynamic qualification of electrical and mechanical equipment important to safety will be performed in accordance with criteria and standards (or the equivalent thereto) cited in this SRP section, thereby ensuring that such equipment is capable of withstanding the seismic and dynamic load effects of natural phenomena in combination with normal and accident conditions.[59]

3. Compliance with GDC 4 requires that components important to safety be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including LOCAs and dynamic effects (e.g., pipe whip, missiles, and discharging fluids).

   GDC 4 applies to this SRP section because the reviewer evaluates seismic and dynamic testing and analysis of electrical and mechanical equipment, plus associated supports, to

ensure that such equipment will withstand seismic and dynamic loads as a result of, or in combination with, other environmental loads.

Meeting the requirements of GDC 4 provides assurance that the seismic and dynamic qualification of electrical and mechanical equipment important to safety will be performed in accordance with criteria and standards (or the equivalent thereto) cited in this SRP section, thereby ensuring that such equipment is capable of withstanding the seismic and dynamic load effects of natural phenomena in combination with normal and accident conditions.[60]

4. Compliance with GDC 14 requires that the RCPB be tested to demonstrate an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture.

GDC 14 applies to this SRP section because the reviewer evaluates seismic and dynamic testing of RCPB components to determine their capability to withstand applicable design basis seismic and dynamic loads in combination with loads caused by other environmental and natural phenomena without leakage, rapidly propagating failure, or rupture. ANSI/IEEE Std 344-1987, as endorsed in Regulatory Guide 1.100, provides guidance acceptable to the staff for establishing acceptable seismic and dynamic test (or evaluation) criteria for RCPB components.

Meeting the requirements of GDC 14 provides assurance that seismic and dynamic qualification of RCPB components will be performed in accordance with criteria and standards (or their equivalent) cited in this SRP section, thereby providing assurance that the RCPB will have an extremely low probability of leakage or failure.[61]

5. Compliance with GDC 30 requires that components that are part of the RCPB be tested to the highest quality standards practical.

GDC 30 applies to this SRP section because the reviewer verifies the adequacy of dynamic test and evaluation programs for RCPB components. ANSI/IEEE Std 344-1987, as endorsed by Regulatory Guide 1.100, provides guidance acceptable to the staff for establishing acceptable seismic and dynamic test (or evaluation) qualification criteria for these components. Additional guidance is provided in SRP Section 3.10 for identifying individual components of the RCPB and demonstrating (i.e., through testing and analysis) that a given component will not leak as a result of any combination of loadings for which it must be qualified. These staff positions include extensive and specific provisions for tests and associated analyses to consider all appropriate seismic and dynamic loads in combination with normal and accident loads.

Meeting the requirements of GDC 30 provides assurance that seismic and dynamic qualification of components that are part of the RCPB will be performed in accordance with criteria and standards (or their equivalent) cited in this SRP section, thereby ensuring that RCPB components will be tested to the highest quality standards practical.[62]

6. Compliance with Appendix B to 10 CFR Part 50 requires that applicants establish and maintain an acceptable quality assurance program, including design, testing, and records control.

Appendix B to 10 CFR Part 50 applies to this SRP section because the reviewer evaluates design, testing, and records for the qualification of equipment, plus associated supports, designated as important to safety. Subsection II.1 describes testing and analysis related to seismic and dynamic qualification of equipment. Subsection II.3 describes recordkeeping requirements for seismic and dynamic qualification of equipment. ANSI/IEEE Std 344-1987, as endorsed by Regulatory Guide 1.100, provides additional guidance for the design, testing, and documentation of the seismic and dynamic qualification of equipment important to safety.

Meeting the requirements of Appendix B to 10 CFR Part 50 provides assurance that designs, tests, and documentation related to qualification of equipment important to safety will comply with established standards and criteria, thereby ensuring that such equipment will be capable of performing its intended safety functions.[63]

7. Compliance with Section VI(a) of Appendix A to 10 CFR Part 100 requires that systems, structures, and components important to safety be designed to resist seismic events.

Section VI(a) of Appendix A to 10 CFR Part 100 applies to this SRP section because the reviewer evaluates seismic and dynamic test and evaluation programs for electrical and mechanical equipment, plus associated supports, designated as important to safety. ANSI/IEEE Std 344-1987, as endorsed by Regulatory Guide 1.100, provides additional guidance for establishing acceptable seismic and dynamic test (or evaluation) qualification criteria for electric and mechanical equipment and associated supports in nuclear power plants. The criteria is applied based on the seismic loads established for a particular site in accordance with 10 CFR Part 100.

Meeting the requirements of Section VI(a) of Appendix A to 10 CFR Part 100 provides assurance that seismic and dynamic qualification of mechanical and electrical equipment, plus associated supports, designated as important to safety is performed in accordance with the criteria and standards (or their equivalent) cited in this SRP section, thereby ensuring that structures, systems, and components important to safety will perform acceptably when subjected to SSE loads and recurring loads equivalent to fractions of the SSE.[64]

III. REVIEW PROCEDURES

The reviewer will select and emphasize material from the procedures described below as may be appropriate for a particular case. The reviewer obtains and uses information from SRP Sections 3.7 and 3.9.2 and consults with ~~SEB and MEB~~ the ECGB[65] as necessary to be assured that the proper seismic and dynamic input motion is being used for the equipment qualification. For each area of review the following review procedures are used:

1. At the CP or design certification[66] stage, the staff reviews the program which the applicant has described in the PSAR or Design Certification Application, respectively[67] for the qualification of mechanical and electrical equipment. The program is measured against the requirements listed in subsection II. Of particular interest are the proper use of test and analytical procedures. Equipment which is too complex for reliable mathematical modeling should be tested unless the analytical procedures and corresponding design are convincingly conservative. Both the test and the analysis methods are reviewed for assurance that all important modes of response will be excited in tests or considered in analysis. Proper consideration of input motions so as to ~~envelope~~envelop[68] the required input, whether in terms of response spectra or time history in all necessary directions is verified. The use and treatment of supports is also reviewed.

2. At the OL stage, the staff reviews the program again as described by the applicant in the FSAR. In addition, the SQR may be reviewed for documentation of the successful implementation of the qualification program including test and analysis results. The reviewer verifies that the applicant's list of systems is consistent with the list provided in accordance with SRP Section 3.2.2.

   To confirm the extent to which the equipment meets the requirements of subsection II, the staff audits the equipment qualification and central files and conducts a plant site review. The staff may require that the ~~Seismic Qualification Report (SQR)~~SQR[69] be submitted to the staff six weeks prior to the plant site visit. If the staff has reviewed an applicant's qualification file for a previous application, they may elect not to require the applicant to submit the SQR, but instead elect only to audit the equipment qualification and central files.

   The review of the SQR, if applicable, and the audit of the applicant's equipment qualification and central files will include the following:

   a. For each system the reviewer should verify that summary data sheets are available for all components of these systems and perform a detailed review of these data sheets for selected components.

   b. The reviewer will audit the central files to verify that the referenced qualification documentation and test reports are available, and perform a detailed review of selected documents to verify that they support the qualification of the equipment. After the site visit, the applicant may be required to submit selected documents for further review.

   c. For selected equipment, the staff reviews the combined required response spectra (RRS) or the combined dynamic response, examines the equipment configuration and mounting, and then determines whether the test of analysis which has been conducted demonstrates compliance with the RRS if the equipment was qualified by test, or the acceptable analytical criteria if qualified by analysis.

d. A sampling of design (functional) specifications shall be reviewed for completeness. For pumps and valves the reviewer utilizes the information contained in the following documents in addition to the acceptance criteria cited under subsections II.1 and II.2 in order to evaluate the functional specifications selected for review:

(1) NRC Regulatory Guide 1.148, "Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants."

(2) ANSI/ASME N278.1-1975 (R-1992),[70] "Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard" (endorsed by Regulatory Guide 1.148, as ~~supplemental~~ supplemented[71] and modified).

(3) ANSI/ASME N551.1, "Standard for Qualification of ASME Code Class 2 & 3 Pump Assemblies for Safety Systems Service, General Requirements" (draft). (Although this draft standard has not been endorsed by the NRC, it will be used for guidance purposes.)[72]

It is important that the ~~applicants~~applicant's[73] program is complete in this area so that the staff may be assured that the proper system parameters are specified and appropriate loads defined. The review will screen several key components in the systems to establish the program objectives.

e. The test procedures are reviewed against the criteria set forth in subsections II.1 or II.2. In evaluating an applicant's program for pumps and valves, the reviewer also utilizes, for guidance purposes, the information contained in the following documents, although these draft documents have not been endorsed by the NRC:

(1) ANSI B.16.41, "Functional Qualification Requirements for Power Operated Active Valve Assemblies for Nuclear Power Plants" (draft);[74]

(2) ANSI N41.6, "Functional Qualification Requirements for Actuators for Power Operated Valve Assemblies for Nuclear Power Plants" ~~(draft)~~;[75]

(3) ANSI/ASME N551.2, "Standard for Qualification of ASME Code Class 2 & 3 Pumps for Safety Systems Service" (draft); and[76]

(4) ANSI N45 N551.4, "Functional Qualification of Motor Drives for Safety Related Code Class 2 and 3 Pumps for Nuclear Power Plants" (draft).[77]

In addition to the above documents, references ~~23 and 24~~22 and 23[78] are utilized by the reviewer to evaluate the operability assurance programs for purge and vent valves and deep draft pumps.

f. The analytical procedures which are used in conjunction with testing or by itself to demonstrate operability are reviewed by comparing the information submitted

in the applicants program with the acceptance criteria delineated in subsections II.1 or II.2. For pumps and valves, the references cited in subsection III.2.e provide additional criteria for demonstrating operability by analysis and are utilized by the reviewer to supplement the staff's review procedures.

3. Reviews of COL applications should include audits of the equipment qualification file. Results of tests and analyses should be reviewed to accomplish the following:

   a. Ensure that the criteria in the certified design were properly implemented,

   b. Ensure that adequate qualification was demonstrated for all equipment and their supports, and

   c. Verify that all applicable loads were properly defined and accounted for in the testing and analyses that were performed.[79]

In the ABWR and System 80+ design certification FSERs the staff accepted an exemption from the 10 CFR 100 Appendix A requirement that all safety-related structures, systems, and components be designed to remain functional and within applicable stress and deformation limits when subjected to an OBE. This exemption was based on the licensees' alternative analyses performed for the SSE and procedural requirements to perform an inspection of the plant following an earthquake at or above one-third the SSE. The staff concluded in SECY 93-087 (Reference 25) that the effect of eliminating the OBE from equipment qualification by analysis should be negligible. Mechanical equipment is generally seismically rugged when properly anchored and its tolerance limits are controlled by the SSE rather than the OBE. However, some electrical equipment qualified by seismic analysis requires an assumed number of OBE events followed by one SSE event. With the elimination of OBE, analysis checks for fatigue effects can be performed at a fraction of the SSE. The staff concluded that equipment should be qualified with five one-half SSE events followed by one full SSE event. Or alternatively, a number of fractional peak cycles equivalent to the maximum peak cycle for five one-half SSE events may be used in accordance with Appendix D of IEEE Standard 344-1987 when followed by one full SSE.[80]

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[81]

IV. EVALUATION FINDINGS

The reviewer should verify that sufficient information has been provided and that the review supports conclusions of the following type (for ~~a CP review~~CP or design certification reviews[82]), to be included in the staff's safety evaluation report (SER):[83]

The staff concludes that the applicant's equipment qualification program is acceptable and meets the relevant requirements of General Design Criteria 1, 2, 4, 14, and 30; Appendix B to 10 CFR Part 50; and Appendix A to 10 CFR Part 100. This conclusion is based on the following:

> The qualification program which will be implemented for mechanical, instrumentation and electrical equipment meets the requirements and recommendations of ~~IEEE 344-1975~~ANSI/IEEE Std 344-1987[84] and the Regulatory Positions of Regulatory Guides 1.61, 1.89, 1.92, 1.100, and 1.148 and provides adequate assurance that such equipment will function properly under all imposed design and service loads including the loadings imposed by the safe shutdown earthquake, postulated accidents, and loss-of-coolant accidents. This program constitutes an acceptable basis for satisfying the applicable requirements of ~~GDC~~ General Design Criteria[85] 2, 4, 14, and 30 of Appendix A to 10 CFR 50 and paragraph XI of Appendix B to 10 CFR 50 and VI(a)(1) and (2) of Appendix A to 10 CFR 100 as they relate to qualification of equipment. The applicant's equipment qualification file also constitutes an acceptable basis for satisfying the requirements of GDC 1 of Appendix A to 10 CFR 50 and paragraph XVII of Appendix B to 10 CFR 50.

At the OL stage, the review should provide justification for a finding similar to that above with the phrase "will be implemented" modified to read "has been implemented."

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[86]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plan for using this SRP section.[87]

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[88] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[89]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 1, "Quality Standards and Records."

2. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

3. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and ~~Missile~~ Dynamic Effects[90] Design Bases."

4. 10 CFR Part 50, Appendix A, General Design Criterion 14, "Reactor Coolant Pressure Boundary."

5. 10 CFR Part 50, Appendix A, General Design Criterion 30," Quality of Reactor Coolant Pressure Boundary."

6. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria For Nuclear PowerPlants and Reprocessing Plants."

7. 10 CFR 100, Appendix A, "Seismic and Geologic Siting Criteria For Nuclear Power Plants."

8. IEEE Std 344-1971, "Guide for Seismic Qualification of Class 1 Electric Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

9. ~~IEEE Std 344-1975~~ANSI/IEEE Std 344-1987, "IEEE Recommended Practice~~s~~[91] for Seismic Qualification of Class lE Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

~~10. K. M. Skrener, E. G. Fischer, S. N. Hou, and G. Shipway, "New Seismic Requirements for Class 1 Electrical Equipment," IEEE Paper T 74 048-5, 1974 Winter Meeting of IEEE Power Engineering Society, Institute of Electrical and Electronics Engineers.~~[92]

~~11~~10. NRC Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Power Plants."

~~12~~11. NRC Regulatory Guide 1.89, "Qualification of Class 1E Equipment for Nuclear Power Plants."

~~13~~12. NRC Regulatory Guide 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis."

~~14~~13. NRC Regulatory Guide 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants."

~~15~~14. IEEE Std 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

~~16~~15. NRC Regulatory Guide 1.148, "Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants."

~~17~~16. ANSI/ASME N278.1-1975 (Redesignated and Reaffirmed 1992),[93] "Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard."

~~18~~17. ANSI/ASME N551.1, "Standard for Qualification of ASME Code Class 2 & 3 Pump Assemblies for Safety Systems Service, General Requirements" (draft).

~~19~~18. ANSI B.16.41, "Functional Qualification Requirements for Power Operated Active Valve Assemblies for Nuclear Power Plants" (draft).

~~20~~19. ANSI N41.6-1972, "Functional Qualification Requirements for Actuators for Power Operated Valve Assemblies for Nuclear Power Plants" ~~(draft)~~.[94]

~~21~~20. ANSI/ASME N551.2, "Standard for Qualification of ASME Code Class 2 & 3 Pumps for Safety Systems Service" (draft).

~~22~~21. ANSI N45 N551.4, "Functional Qualification of Motor Drives for Safety Related Code Class 2 and 3 Pumps for Nuclear Power Plants" (draft).

~~23~~22. Enclosure to September 27, 1979, Letter from D. G. Eisenhut, Acting Director, Division of Operating Reactors, NRR, USNRC, to all Licensees of Operating Reactors, entitled, "Guidelines for Demonstration of Operability of Purge and Vent Valves."

~~24~~23.[95] Enclosure to June 22, 1981, Memorandum from R. Vollmer, Director, Division of Engineering, NRR, USNRC, to D. Eisenhut, Director, Division of Licensing, NRR, USNRC, entitled, "Guidelines for Demonstration of Operability of Deep Draft Pumps."

24. NRC Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident."[96]

25. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," April 2, 1993; SRM-93-087 issued on July 21, 1993.[97]

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SRP Draft Section 3.10
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current primary review branch and abbreviation	Changed to reflect current PRB responsibility for SRP Section 3.10.
2.	Current secondary review branch and abbreviation	Changed to reflect current SRB responsibility for SRP Section 3.10.
3.	Editorial	Changed "assure" to "ensure."
4.	Current primary review branch abbreviation	Changed to reflect current PRB responsibility for SRP Section 3.10.
5.	Editorial	Changed "assure" to "ensure."
6.	Editorial	Defined SRP.
7.	Integrated Impact No. 264	Added sentence to describe instrumentation that is included in AREAS OF REVIEW for seismic and dynamic qualification.
8.	Integrated Impact No. 269	Added specific reference to snubbers as mechanical equipment covered by this SRP section. (Item 4 of Attachment A of 5/5/92 NRC Memo from Baer to Norberg)
9.	Editorial	Moved text from next to last paragraph of Subsection I into this paragraph because EMEB is now assigned PRB responsibility. (See item 20 in this table.)
10.	Integrated Impact No. 264	Restored secondary Review Branch responsibility to HICB, similar to that under Revision 1 of the SRP section (NUREG 75-087). The description of HICB responsibility was adapted from NUREG 75-087 (last paragraph under AREAS OF REVIEW) and supplemented to include specific reference to accident monitoring instrumentation per Integrated Impact No. 264. The responsibility for verifying that equipment and instrumentation mounting adequately simulates actual service mounting is considered to be an EMEB responsibility, therefore the portion of the paragraph in NUREG 75-087 that covers this subject was omitted. (Section 3.10 of NUREG 75-087)
11.	SRP-UDP format item	Added "and design certification" to the first sentence of the 5th paragraph under AREAS OF REVIEW to indicate review responsibilities. (Per 10 CFR Part 52)
12.	Editorial	Changed "assure" to "ensure."
13.	Editorial	Changed "assure" to "ensure."
14.	Editorial	Changed "assure" to "ensure."
15.	SRP-UDP format item	Added "Review Interfaces" to AREAS OF REVIEW.

Item	Source	Description
16.	**Potential Impact # 21739**	Added a Review Interface with SRP Section 3.6.2 to be consistent with existing Acceptance Criteria II.C and to provide a path to SRP Section 3.6.3 regarding review of leak-before-break analyses, if applicable.
17.	Current primary review branch abbreviation	Changed to reflect current PRB responsibility for SRP Section 3.10.
18.	Editorial	Changed period to colon.
19.	Editorial	Added numbering to reflect the addition of a subsequent review interface.
20.	Current secondary review branch designation and abbreviation	Changed to reflect current SRB review branch and responsibility.
21.	SRP-UDP format item	Changed to indicate that EMEB is now the Primary Review Branch. Moved sentences to the appropriate location in this SRP section. See item 8 in this table.
22.	SRP-UDP Integration of Bolting Issues, Potential Impact 999	Added a review interface reflecting reviews of bolting and threaded fastener programs under new SRP Section 3.13.
23.	Editorial	Defined "General Design Criterion 1" as "GDC 1."
24.	Editorial	Defined "General Design Criterion 30" as "GDC 30."
25.	Editorial	Defined "General Design Criterion 2" as "GDC 2."
26.	Editorial	Defined "General Design Criterion 4" as "GDC 4."
27.	Editorial	Defined "General Design Criterion 14" as "GDC 14."
28.	Editorial	Changed period to colon.
29.	SRP-UDP update item	Deleted reference to "plants for which the CP application was docketed after October 27, 1972" because all plants to be covered by this revision of the SRP belong to this category. All plants with applications docketed before October 27, 1972, have either been licensed, canceled, or reviewed by the staff against a previous version of the SRP.
30.	Integrated Impact No. 263	Changed IEEE 344-1975 to ANSI/IEEE Std 344-1987 to reflect latest staff guidance contained in Regulatory Guide 1.100.
31.	Integrated Impact No. 263	Revised wording to include guidance contained in Discussion of Regulatory Guide 1.100, which outlines changes from IEEE 344-1975 and includes the staff position on use of justified experience data.
32.	SRP-UDP format item	Changed "transient" to "AOO" per Generic Issue B-3.
33.	Editorial	Changed "assure" to "ensure."

Item	Source	Description
34.	Integrated Impact No. 264	Added limiting phrase to sentence to agree with position stated in (new Subsection) II.2. Accident monitoring instrumentation should be appropriately qualified if it is not located in seismically qualified buildings and citing Subsection II.2 will provide appropriate assurance.
35.	Editorial	Changed "assure" to "ensure."
36.	Integrated Impact No. 273	Added sentence to conform to NRC positions on limiting stresses in valve bodies and pump casings. (ABWR FSER Section 3.10)
37.	Integrated Impact No. 263	Changed IEEE 344-1975 to ANSI/IEEE Std 344-1987 to conform to latest staff guidance contained in Regulatory Guide 1.100.
38.	Editorial	Defined "LOCA" as "loss-of-coolant accident."
39.	Editorial	Changed "assure" to "ensure."
40.	Integrated Impact No. 263	The first sentence of the existing paragraph was made obsolete by the adoption of ANSI/IEEE Std 344-1987 by the NRC staff and the resulting revision of Regulatory Guide 1.100. The current version of Regulatory Guide 1.100 does not describe ANSI/IEEE Std 344-1987 as an "ancillary standard" to IEEE Std 323-1974 and therefore the statement required correction. The second sentence of the paragraph was modified because the reference to "plants whose construction permit SER is dated July 1, 1974, or later" is redundant. All plants that will be covered by this SRP revision are in this category. (Last paragraph of Section 4 of ANSI/IEEE Std 344-1987)
41.	Integrated Impact No. 264	Added Subsection II.2. to ensure that instrumentation will be seismically qualified. The text was adapted from the 4th paragraph of the Introduction to Regulatory Guide 1.97 as well as the 4th paragraph of Item 1 of Table 1 of Regulatory Guide 1.97.
42.	SRP-UDP update item	Deleted existing Subsection II.2. There are only two plants whose CP applications were docketed before October 27, 1972, and are yet to be licensed, and thus could conceivably be covered by the deleted Subsection II.2. These plants are Watts Bar 1 and 2. All other pre-1972 plants have either been licensed or canceled. A study of the SER for Watts Bar revealed that the issues of concern for pre-1972 plants, as described in Revision 2 of SRP Section 3.10, Subsection II.2., were addressed by the applicant and approved by the staff. Therefore, the paragraph is no longer applicable.

Item	Source	Description
43.	Editorial	Existing citation of "paragraph 2 of Subsection I" is incorrect.
44.	Editorial	Defined NSSS.
45.	Editorial	Defined BOP.
46.	Editorial	Provided "RCPB" as initialism for "reactor coolant pressure boundary."
47.	Editorial	Substituted "GDC 14" for "General Design Criterion 14, as defined in item 25 above.
48.	Editorial	Used RCPB as defined in item 47 above (global change for this section).
49.	Editorial	Substituted "GDC 30" for "General Design Criterion 30, as defined in item 22 above.
50.	Editorial	Defined PSAR.
51.	Editorial	Defined A/E.
52.	Editorial	Defined FSAR.
53.	Editorial	Existing citation of "paragraph 2 of Subsection I" is incorrect.
54.	Editorial	Existing citation of "paragraph 2 of Subsection I" is incorrect.
55.	Editorial	Existing citation of "paragraph 2 of Subsection I" is incorrect.
56.	SRP-UDP format item	Added new subsection II.5.d., adapted from the ABWR FSER and CE System 80+ FSER, to indicate that the staff should determine that COL applicants furnish the described additional information. (per 10 CFR Part 52)
57.	SRP-UDP format item	"Technical Rationale" added to ACCEPTANCE CRITERIA and formatted in numbered paragraphs to describe the bases for referencing the General Design Criteria and other regulations.
58.	SRP-UDP format item	Added technical rationale for GDC 1.
59.	SRP-UDP format item	Added technical rationale for GDC 2.
60.	SRP-UDP format item	Added technical rationale for GDC 4.
61.	SRP-UDP format item	Added technical rationale for GDC 14.
62.	SRP-UDP format item	Added technical rationale for GDC 30.
63.	SRP-UDP format item	Added technical rationale for Appendix B to 10 CFR Part 50.

Item	Source	Description
64.	SRP-UDP format item	Added technical rationale for Appendix A to 10 CFR Part 100.
65.	Current review branch abbreviation	Changed to reflect current review branch designations.
66.	SRP-UDP format item	Added designation to indicate the review procedures to be applied at the design certification stage. (Per 10 CFR part 52)
67.	SRP-UDP format item	Added "or Design Certification Application, respectively" to indicate the review procedures to be applied. (Per 10 CFR Part 52)
68.	Editorial	Changed "envelope" to "envelop."
69.	Editorial	Deleted redundant phrase "Seismic Qualification Report" because the acronym is defined in Subsection II.5.c.
70.	Integrated Impact No. 653	Indicated that standard was redesignated as an "ANSI/ASME" standard and reaffirmed in 1992.
71.	Editorial	Corrected "supplemental" to "supplemented."
72.	Editorial note without change	No change was made to Subsection III.2.d.(3). ANSI/ASME N551.1 (DRAFT) is unavailable. The qualification of pump assemblies, excluding motors, instrumentation, and control devices, is now covered by ASME QME-1-1994, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." ASME QME-1-1994 is yet to be reviewed and accepted by the NRC staff.
73.	Editorial	Added apostrophe.
74.	Editorial note without change	No change was made to Subsection III.2.e(1). ANSI B16.41 (DRAFT) is obsolete and unavailable. ANSI B16.41 has been issued but has not been endorsed by the NRC staff. ANSI B16.41-1983 was revised and redesignated as Section QV and its Appendix A of ASME QME-1-1994, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." ASME QME-1-1994 is yet to be reviewed and accepted by the NRC staff.
75.	**Integrated Impact No. 1490**	Removed "(draft)" designator based upon RG 1.73 endorsement of IEEE Std 382-1972 (also designated ANSI N41.6-1972).

Item	Source	Description
76.	Editorial note without change	No change was made to Subsection III.2.e(3). ANSI/ASME N551.2 (DRAFT) is unavailable. The qualification of pump assemblies, excluding motors, instrumentation, and control devices, is now covered by ASME QME-1-1994, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." ASME QME-1-1994 is yet to be reviewed and accepted by the NRC staff.
77.	Editorial note without change	No change was made to Subsection III.2.e(4). ANSI N45 551.4 (DRAFT) is unavailable. Qualification of Class 2 and 3 pump motors (ANSI N45 551.4) is not specifically addressed by a current standard but appears to be within the scope of IEEE Std 334-1971 "IEEE Trial Use Guide for Type Tests of Continuous Duty Class 1E Motors for Nuclear Power Generating Stations" which is endorsed by Regulatory Guide 1.40, "Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants." The latest version was issued as ANSI/IEEE Std 334-1974 (Reaffirmed 1980). IEEE Std 334-1971 and 1974 are listed as withdrawn (1993) in NUREG/CR-5973, Revision 1, "Codes and Standards and Other Guidance Cited in Regulatory Documents."
78.	Editorial	Revised reference numbers to suit added and deleted references.
79.	10 CFR Part 52, Subpart C, Combined Licenses	Added paragraph III.3, adapted from the ABWR FSER and CE System 80+ FSER, to REVIEW PROCEDURES to cover COL applications.
80.	**Integrated Impact 266**	Added a discussion of alternative approaches that may be used for determining the number of cycles to be used in the analysis of equipment upon elimination of the OBE.
81.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
82.	10 CFR Part 52, Subpart C, Combined Licenses	Added reference to design certification reviews in EVALUATION FINDINGS regarding CP reviews.
83.	Editorial	Defined "SER" to "safety evaluation report."
84.	Integrated Impact No. 263	Changed IEEE Std 344-1975 to ANSI/IEEE Std 344-1987 to conform to latest staff guidance contained in Regulatory Guide 1.100.
85.	Editorial	Substituted "General Design Criteria" for "GDC" to accommodate plural context.

Item	Source	Description
86.	SRP-UDP Format Item, Implement 10 CFR 52 Related Changes	To address design certification reviews a new paragraph was added to the end of the Evaluation Findings. This paragraph addresses design certification specific items including ITAAC, DAC, site interface requirements, and combined license action items.
87.	Editorial	Broke paragraph at this point to conform with format used in other SRP sections.
88.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
89.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
90.	SRP-UDP format item	Updated title for GDC 4.
91.	Integrated Impact No. 263	Changed IEEE Std 344-1975 to ANSI/IEEE Std 344-1987 to conform to latest staff guidance contained in Regulatory Guide 1.100 and corrected title.
92.	Integrated Impact No. 263 Editorial	Deleted (original numbered) reference 10 which is not applicable and unavailable. This reference is described by one of its authors as a commentary on IEEE Std 344-1975. It was never cited in the body of the SRP section. No copy could be obtained. This reference was also in NUREG 75-087 (original SRP) and was not cited in the body of Section 3.10 of that document either.
93.	Editorial	Cited reference to ANSI N278.1 as redesignated (ASME/ANSI) and reaffirmed in 1992.
94.	**Integrated Impact No. 1490**	Added version date and removed "(draft)" designator based upon RG 1.73 endorsement of IEEE Std 382-1972 (also designated ANSI N41.6-1972).
95.	Editorial	Renumbered references.
96.	Integrated Impact No. 264	Added new reference 24 for Regulatory Guide 1.97, referring to accident monitoring and other instrumentation.
97.	**Integrated Impact 266.**	Added SECY-93-087 as a reference to this SRP section.

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Integrated Impact No.	Issue	SRP Subsections Affected
263	Update SRP Section 3.10 to reflect staff positions presented in Regulatory Guide 1.100, Rev. 2. Replace references to IEEE Std 344-1975 with references to ANSI/IEEE Std 344-1987.	ACCEPTANCE CRITERIA, II.1. ACCEPTANCE CRITERIA, II.1.a(1) ACCEPTANCE CRITERIA, II.1.a(13) ACCEPTANCE CRITERIA, II.1.c ACCEPTANCE CRITERIA, Items 1, 4, 5, 6, and 7 of new "Technical Rationale" Subsection. EVALUATION FINDINGS, IV, "standard findings" paragraph Reference 9
264	Revise SRP Section 3.10 to include guidance from Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants To Assess Plant and Environs Conditions During and Following an Accident."	AREAS OF REVIEW, I, 4th paragraph ACCEPTANCE CRITERIA, II.1.a(3) ACCEPTANCE CRITERIA, II.2 Added new Reference 24
266	Eliminate use of the OBE as a design basis earthquake.	REVIEW PROCEDURES, Subsection III REFERENCES, Subsection VI.
267	Cite ASME QME-1-1994, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants" in place of obsolete (draft) references.	No changes were made to SRP Section 3.10 based on this Integrated Impact. No suitable replacements are available for these references.
268	Add a discussion of Generic Letter 87-02, "Verification of Seismic adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46," and Generic Letter 89-18, "Resolution of Unresolved Safety Issue A-17, 'Systems Interactions in Nuclear Power Plants,'" in SRP Section 3.10	No changes were made to SRP Section 3.10 based on this Integrated Impact. These generic letters do not apply to any plants that will be reviewed by the staff using Revision 3 of the SRP.
269	Add specific reference to snubbers in the examples of equipment covered by SRP Section 3.10.	AREAS OF REVIEW, I (second paragraph)

SRP Draft Section 3.10
Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
270	Revise Acceptance Criteria subsection to address common design and analysis practices with regard to stiffness of anchorage of heavy equipment. Generic Issue 146 indicates that it is "common industry practice" to assume rigid attachments between equipment and supports, and this assumption may be nonconservative.	No changes were made to SRP Section 3.10 based on this Integrated Impact. The generic issue that identifies this concern is yet to be resolved. It also appears that the guidance contained in Subsections II.1.a(7) and (8) generally covers this concern.
271	Delete reference to ANSI B.16.41 (draft).	No changes were made SRP Section 3.10 based on this Integrated Impact. The citation of B16.41 (draft) in SRP Section 3.10 was retained because no replacement has been accepted by the staff. See Integrated Impact No. 267.
272	Revise Review Procedures section to incorporate IEEE Std 382-1985 in place of ANSI N41.6 (draft)	No changes were made to SRP Section 3.10 based on this Integrated Impact. See Integrated Impact No. 1490.
273	Limit stresses in valve bodies and pump casings to the elastic limit for SSE in combination with normal operating loads and other dynamic loads	ACCEPTANCE CRITERIA, II.1.a(9)
653	SRP Section 3.10 cites ANSI N278.1 1975. The cited version was redesignated and reaffirmed in 1992. Consideration should be given to citing the reaffirmed version of this standard.	REVIEW PROCEDURES, Subsection III. REFERENCES, Subsection VI.
1490	Consider updating the citation of ANSI N41.6 (draft) to cite the IEEE 382-1972 version.	REVIEW PROCEDURES, Subsection III.2.e(2) REFERENCES, Subsection VI